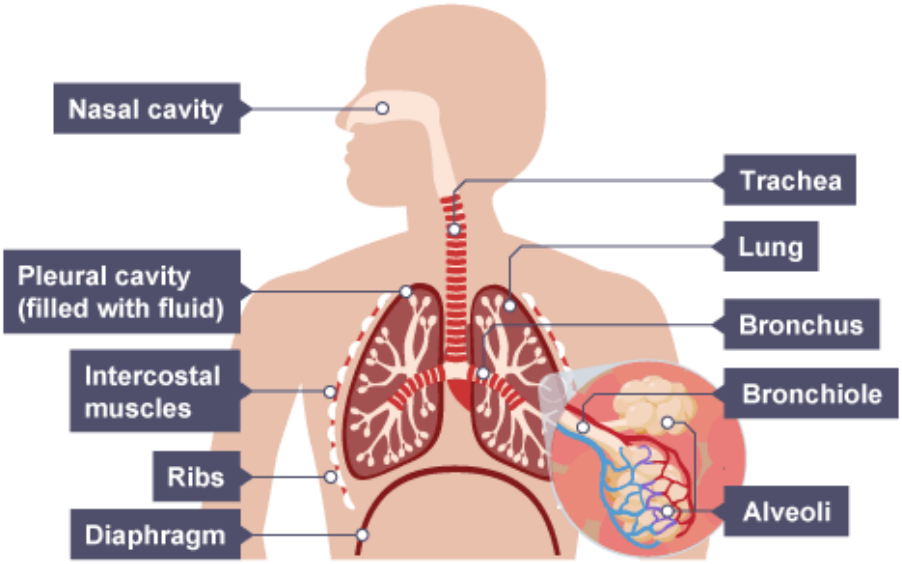
Human Gas Exchange and Ventilation

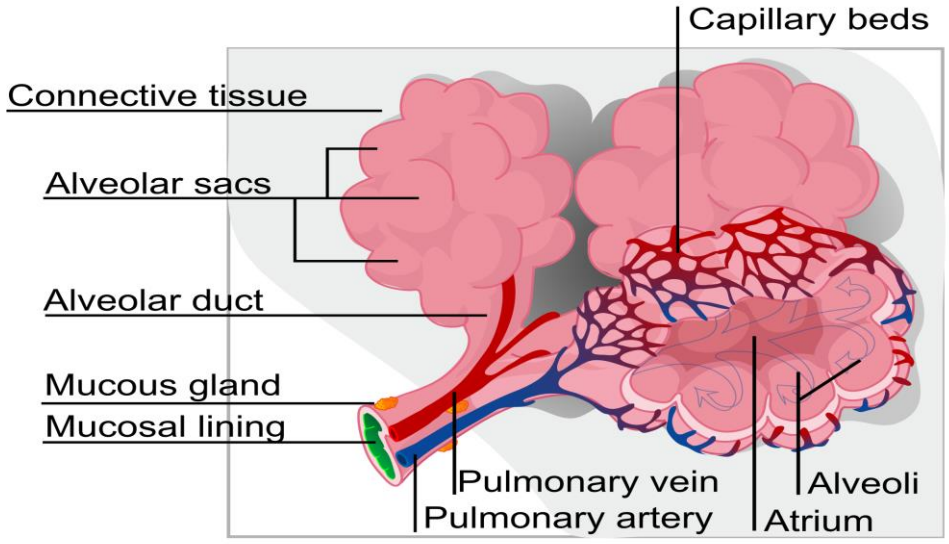
Gas exchange: The process by which gases (oxygen and carbon dioxide) are transferred across the alveoli by diffusion.

Ventilation: The mechanism of inhaling and exhaling to move gases into and out of the lungs using the help of muscles such as the intercostal muscles and the diaphragm.

Structure of the human gas exchange system:



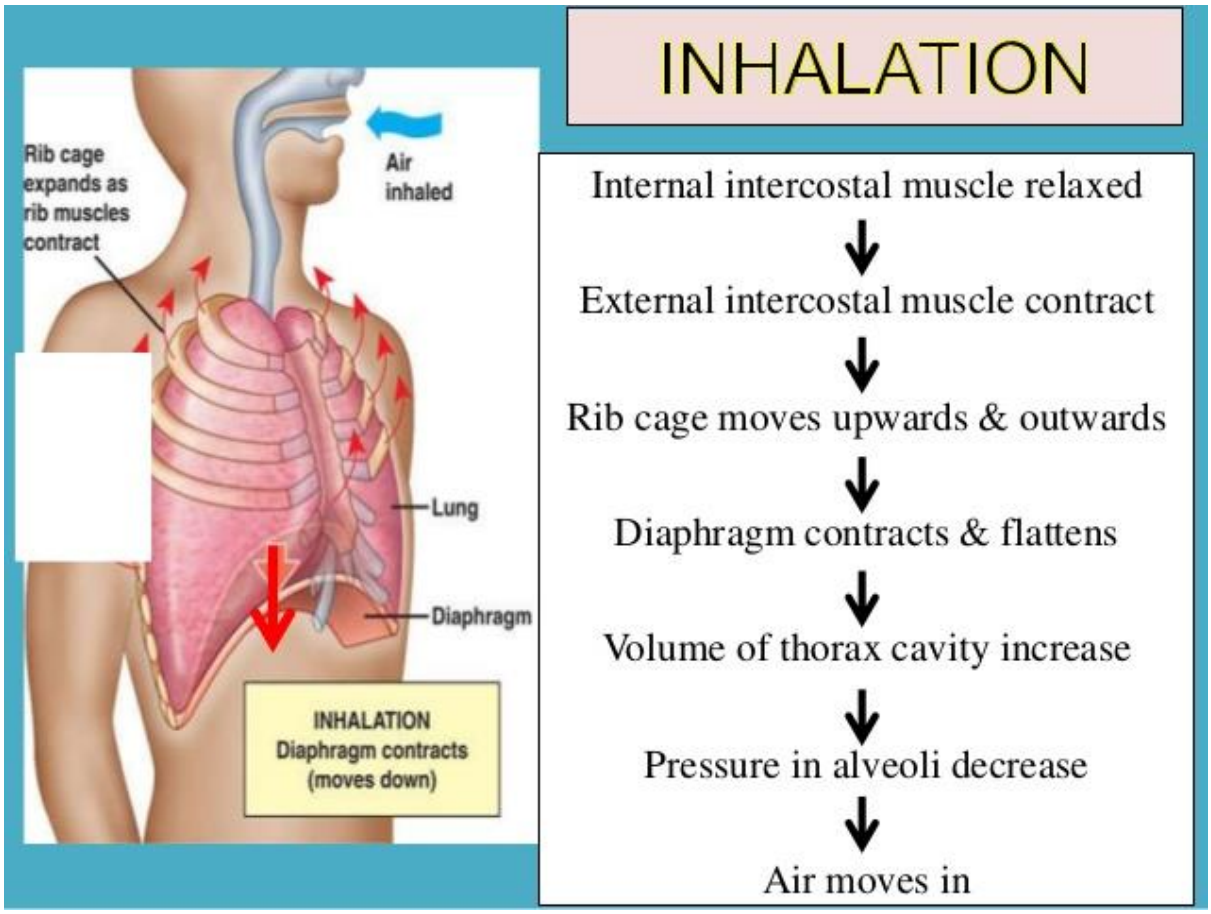
Structure of the alveolus (site of gas exchange in humans)



The alveoli are adapted for gas exchange in the following ways:

- Large surface area to volume ratio for rapid diffusion
- Thin walls (one cell thick) for quick diffusion.
- Good blood supply. Maintains the concentration gradient for quick diffusion.
- Moist lining so that gases can dissolve easily.

Human ventilation mechanism:



Opposite changes during exhalation.

Internal intercostal muscles contract, external intercostal muscles relax, rib cage moves downwards and inwards, diaphragm relaxes and becomes dome shaped. Volume inside the thorax reduces and pressure increases, forcing air out.

Impact of smoking on gas exchange:

Emphysema: damage to the alveolar walls.

Bronchitis: inflammation of the bronchi due to the irritants in cigarette smoke.

COPD: Chronic bronchitis + emphysema.

Lung cancer: from carcinogens such as tar in cigarette smoke.

Carbon monoxide will reduce oxygen carriage by haemoglobin to the cells.